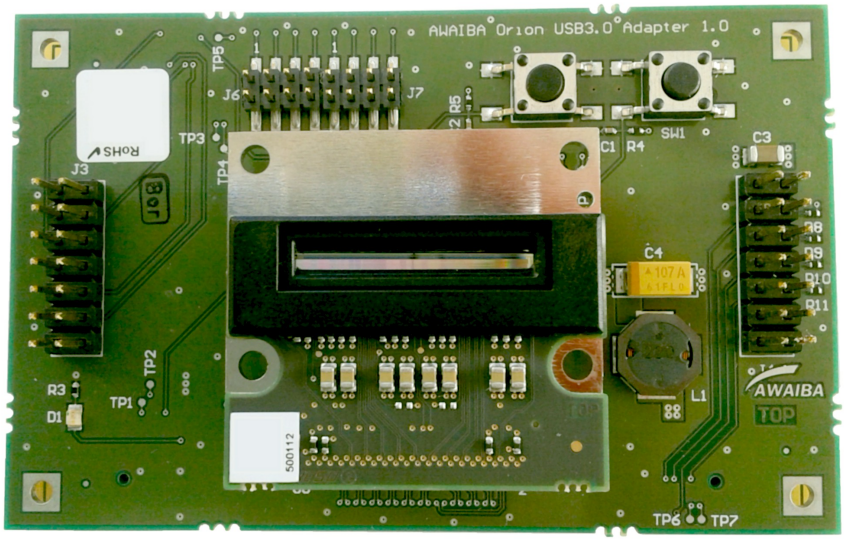

ORION USB3
Evaluation Kit

AWAIBA

Revision History:

Version	*Date*	*Modifications*	*Author*
1.0.0	27/02/15	Document creation	Duarte Goncalves
1.0.1	16/03/15	Updated Document	Fátima Gouveia
1.0.2	18/05/15	Added External Trigger section	Fátima Gouveia

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1 General Description

This document pretends to be a user manual to the Awaiba ORION evaluation kit . The ORION eval kit is demonstration kit is a two-board system used to evaluate the Awaiba ORION 1K and 2K line CMOS image sensor. The kit consists of the CMOS image sensor and a circuit board containing all support circuits necessary to operate the CMOS image sensor. In addition, the kit includes software the permits for any use to acquire data and configure the system through an USB3 interface.

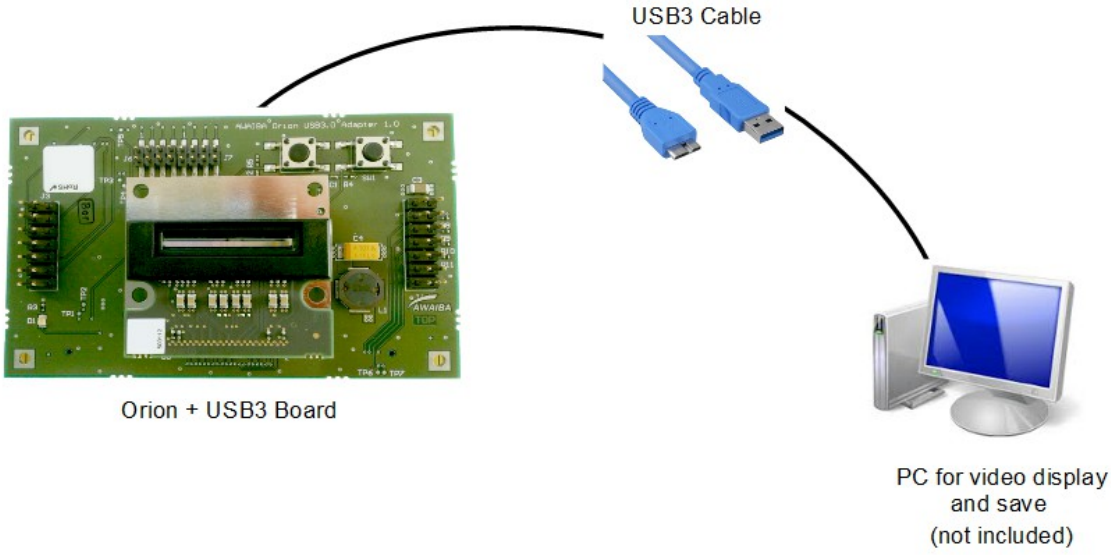

Figure 1: Orion evaluation set overview

2 System Overview

The evaluation kit is composed of two boards, one off-the-shelf USB-FPGA interface and another one specific to the Orion sensor.

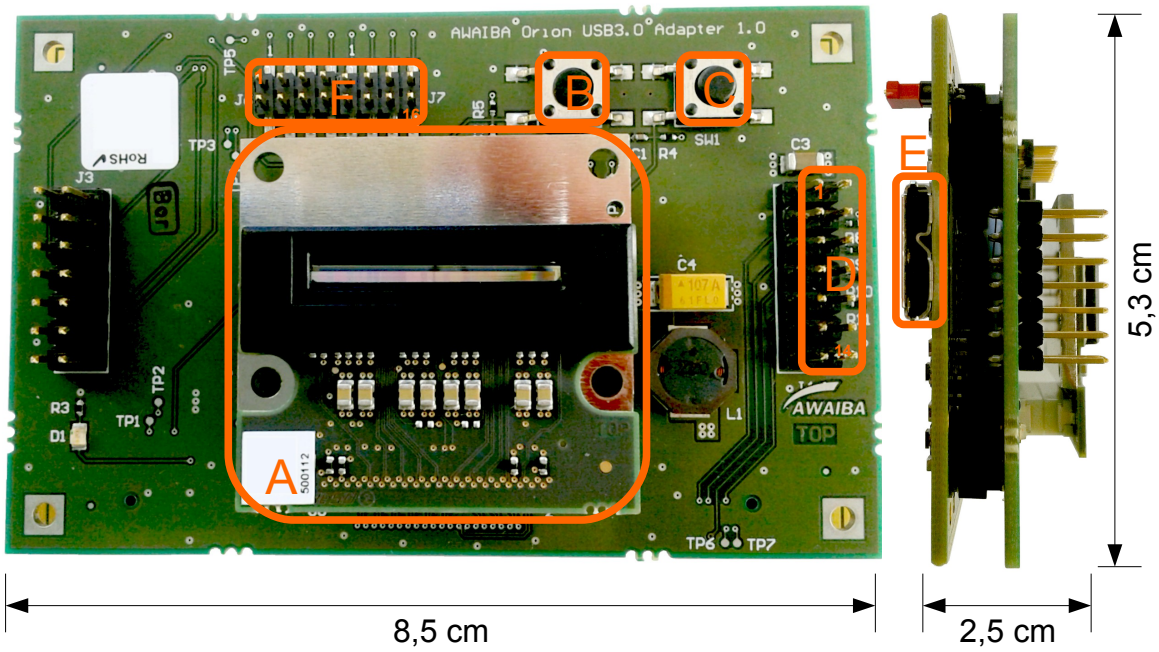

Figure 2: ORION interface board

Legend		
A	Orion sensor: 1K or 2K	
B	FX3 USB 3 controller reset button	
C	FPGA soft reset button	
D	JTAG connection pin: 1, 2, 4, 6, 8, 10	
E	USB3 plug	
F	GPIO: 1 - External trigger Input	11 - MOSI
	2 - VCC	13 - SCLK
	3 - LVAL Segment 2	15 - N_CS
	6 - LVAL Segment 1	
	9 - MISO	

Table 1: Orion interface board

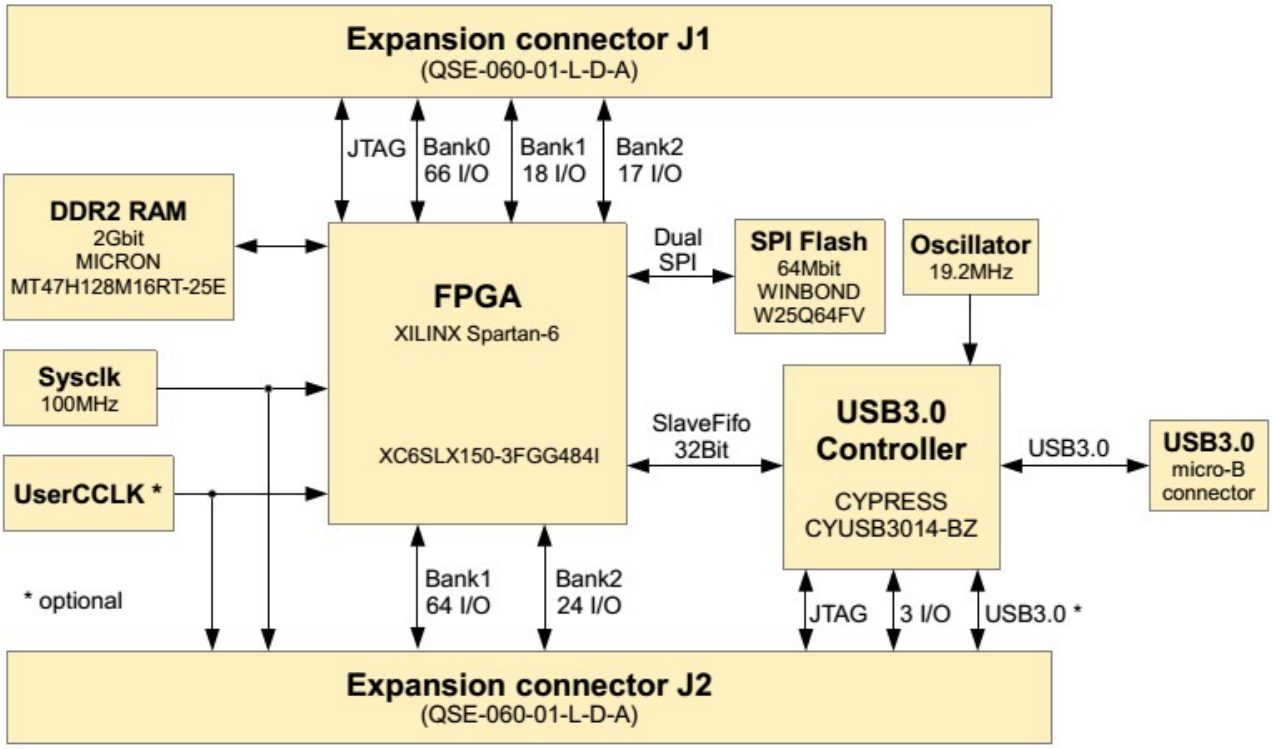

Figure 3: FPGA – USB board functional Diagram

The off-the-shelf USB/FPGA board is an embedded module featuring a XILINX™ SPARTAN-6 FPGA in conjunction with the CYPRESS™ FX3 SuperSpeed USB 3.0 interface controller.

Main Features:

- USB3.0 SuperSpeed interface through versatile CypressTM EZ-FX3 controller
- USB bus-powered, no external power supply necessary
- Two FX3 GPIO on expansion connector
- XilinxTM Spartan-6 FPGA (LX150)
- 2Gbit DDR2 memory
- 64Mbit dual SPI configuration/data memory
- High stability 100MHz +/-25ppm onboard clock oscillator
- 512Kbit I²C EEPROM for FX3 configuration data
- I²C interface available on expansion connector to increase available FX3 configuration memory for standalone applications
- FPGA configuration from SPI memory, JTAG or USB 3
- JTAG for FPGA and FX3 controller available on expansion connectors

3 Operating Instructions

The kit is factory adjusted and operational when received. This section lists recommended equipment, basic operational instructions, include signal voltage level requirements, options that are factory selected but that are easily modified by the user.

3.1 Recommended Equipment

- Oscilloscope
- Desktop PC (recommended)
- USB3 Port
- Signal Generator

3.2 Resolution / Fame rate and ADC gain settings

The chip has the capability of increasing the output Line Rate by reducing the ADC resolution. For each ADC resolution there is different Gains.

For 13 bits resolution, it is possible to achieve 20KHz, with integration time defined as 40us.

Table 2 exemplifies, for instance, the recommended ADC gain configuration for resolution 13 bits, 12 bits and 11 bits.

Resolution	Frame Rate	ADC time	Analogue Gain Register 0x04
13 bits	20 KHz	40 us	CF
12 bits	40 KHz	22 us	9F
11 bits	70 KHz	11 us	40

Table 2: ADC resolution configuration

3.3 Auxiliary pixel settings

This sensor has the unique feature of have two pixel sizes option available for the user. Basically the user can choose between a small photo diode pixel 10 um x 10 um, and larger one with 10 um x 200 um.

	Reg 0x08	Reg 0x02
Large Pixel 10 um x 200 um	**Bit 7 = 0**	CVC Gain = 1x **Bit 3 = 1**
Smaller Pixel 10 um x 10 um	**Bit 7 = 1**	CVC Gain = 11x **Bit 3 = 0**

Table 3: Pixel size configuration

3.4 External Trigger Input

As an example of the signal that can be connected to the external trigger pin, please use a pulse generator with 970Hz and make sure that between each pulse you have 1ms.

Please change the FPGA register 0, Sensor Operation Control to 0x07.

3.5 Test Mux Signals reading

In order to check the test mux channel, it possible to access that particular signal from the pad indicated on the figure.

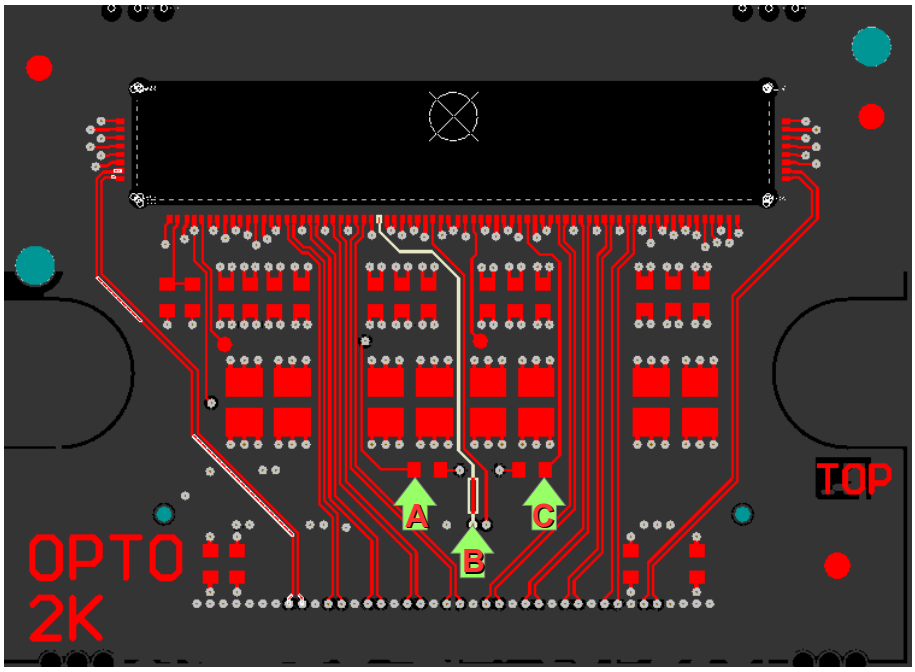

Figure 4: OPTO Head Board pin out assignment

Legend	
A	Test MUX 1st segment output pad
B	LVAL Signal
C	Test MUX 2nd segment output pad

Table 4: Head board pin out

3.6 Readout Implementation

The readout implementation on VHDL takes the 8 LVDS on OPTO/ORION 2K and 4 LVDS on OPTO/ORION 1K outputs and combines them two by two in order to have the 4/2 buses: Segment1_A + Segment1_B (for OPTO/ORION 2K and 1K) and Segment2_A + Segment2_B(for OPTO/ORION 2K only). These segments are organized according the following diagram:

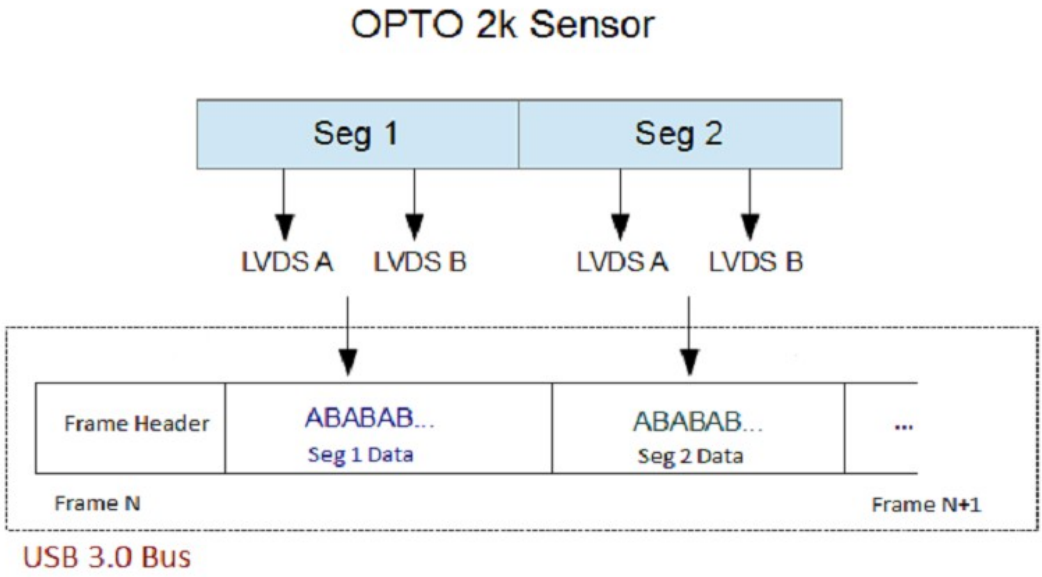

Figure 5: Orion readout implementation

4 Evaluation Software

The evaluation system comes with the USB evaluation unit that receives data from the FPGA-Module with one or more sensors and the windows software to run the camera on a PC in real-time. Image display and storage is provided. It has the following features:

- Possibility to adjust all sensor registers
- Possibility to adjust Line rate and integration time
- Possibility to save snapshots in PNG
- Load in runtime a new configuration and change the sensor/board to receive images

An API interface to the data stream is available for easy integration in existing display systems and evaluation of image processing algorithms.

The most recent version of the software and manuals are available under:
http://www.awaiba.com/software/

5 Troubleshooting

5.1 How to Install Awaiba Line Viewer

Please take a look into page 6, section 2, on Orion Viewer Quick Start file. Please find here http://www.awaiba.com/software/ the file.

5.2 How to Start Awaiba Line Viewer

Please take a look into page 12, section 4.1, on Orion Viewer Quick Start file. Please find here http://www.awaiba.com/software/ the file.

5.3 How to Use Awaiba Line Viewer

Please take a look into page 13, section 4.2, on Orion Viewer Quick Start file. Please find here http://www.awaiba.com/software/ the files.

5.4 How to Debug Orion USB3 board

If you can not receive images, this section can help you to debug the board.

When the viewer is installed, inside the **application/debug/USB3** folder, there is several programs that can be used to debug the user's problem.

First, you should start the Template. Following the instructions on that window you should download the firmware and then program the FPGA. You can find the bit file at **\ProgramData\Awaiba\Orion Viewer\FPGA Files**.

When this task is completed you should be able to have the information as in the image 6.

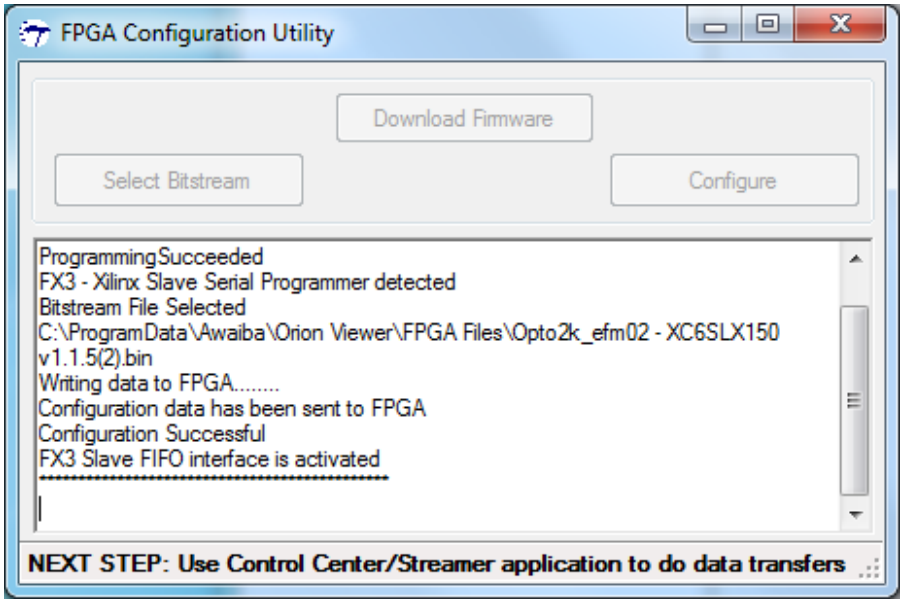

Figure 6: FPGA Configuration

After this a LED should turn on, on the USB3 board.

Secondly, start the USB Control Center (CyControl.exe). You should have two end points as shown in figure 7.

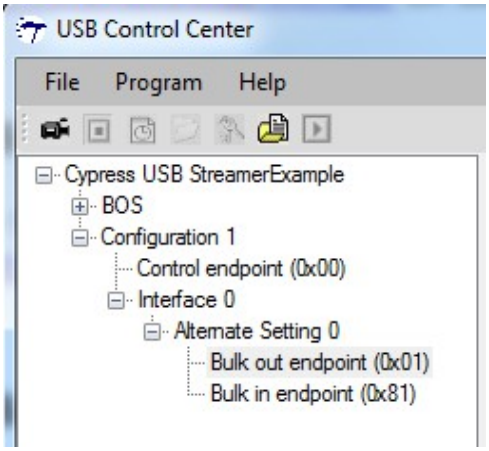

Figure 7: Orion USB3 Endpoints list

Then, click the **Bulk out endpoint (0x01)** and on the **Data Transfers** tab, write the commands, as exemplified on figure 8:

- 23 06 02 00 20 C9 0D
- 23 06 02 00 27 A2 0D

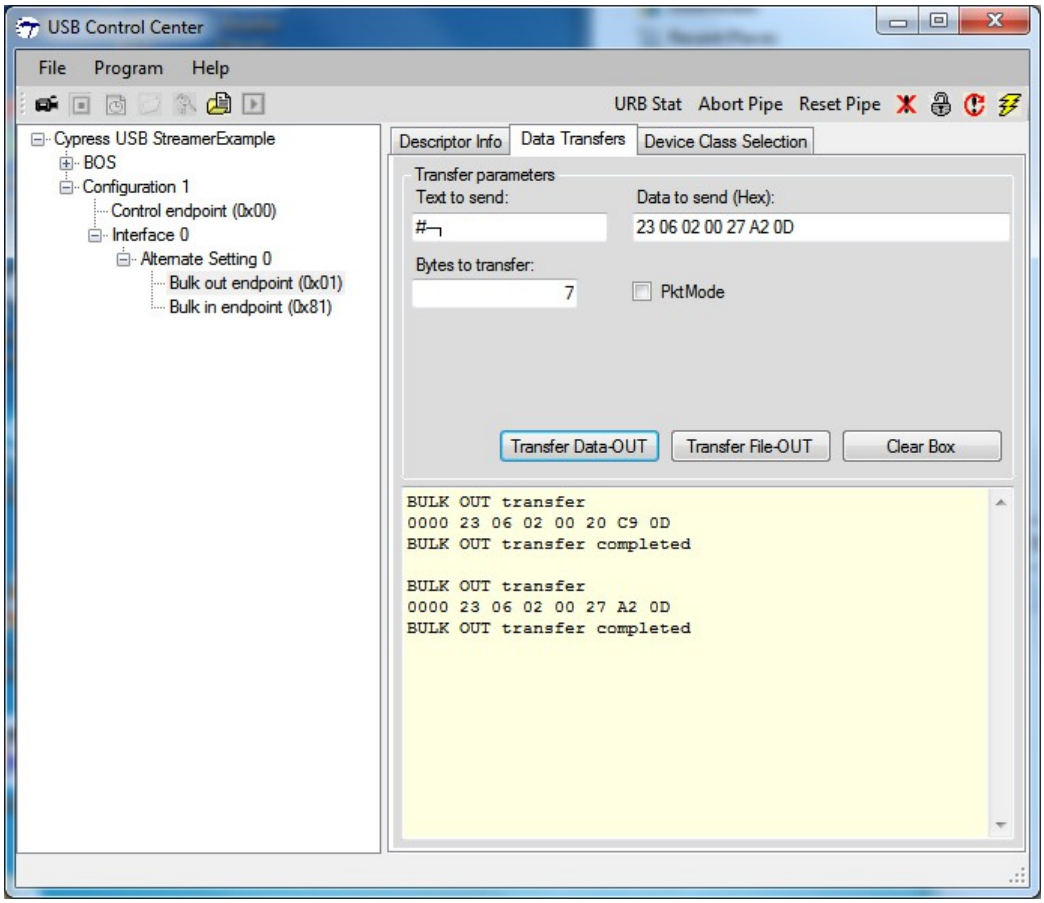

Figure 8: Write to endpoint 0x01

After this, you should see a LED blinking on the USB3 board.

Please start the streamer program with the 0x81 endpoint, 32 packets per Xfer and 16 Xfers to Queue. Then click start, and you should get data from this end point, as shown in figure 9.

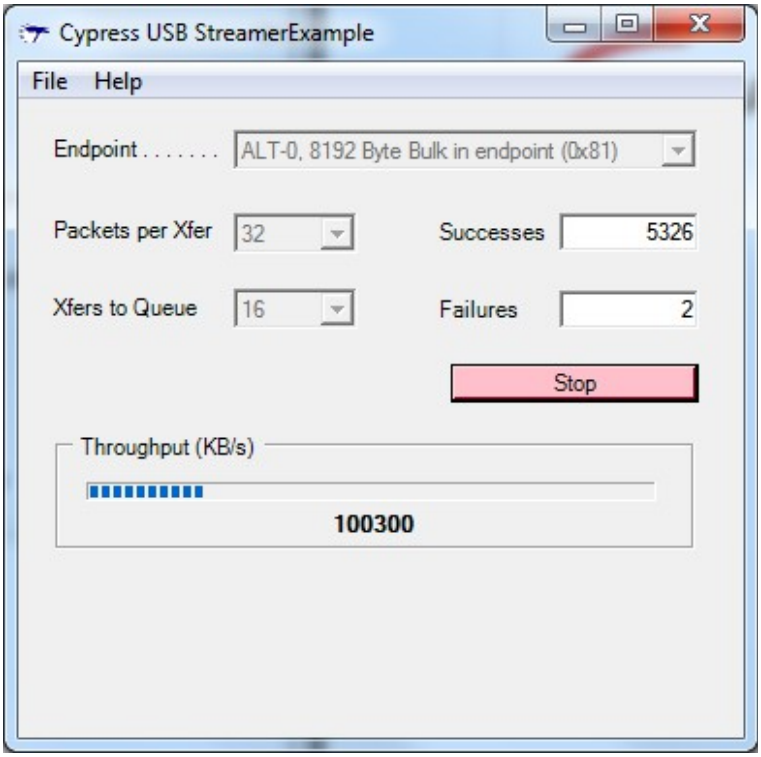

Figure 9: Streamer example data from endpoint 0x81

If you have around 100300 KB/s, then the transfer rate is good, and you are receiving all the data from the sensor. If the data is lower than that, you should use a USB3 PCI adapter.

For additional information or assistance please contact our technical support through **support@awaiba.com** or visit our website on www.awaiba.com/support.

End of Document